

87. The network of claim 86,  
further is always capable of setting up said connection by never changing path of a  
previously set up multicast connection, and the network is hereinafter “strictly  
nonblocking network”.
- 5 88. The network of claim 85 comprising a controller in communication with said  
input, output and middle stages to set up said multicast connection.
89. The network of claim 86 wherein said  $r_1$  input switches and  $r_2$  output switches  
are the same number of switches.
90. The network of claim 86 wherein said  $n_1$  inlet links and  $n_2$  outlet links are the  
10 same number of links and  $n_1 = n_2 = n$ , then  $m \geq 3 * n - 1$ .
91. The strictly nonblocking network of claim 87,  
wherein each of said input switches, or each of said output switches, or each of  
said middle switches further recursively comprise one or more strictly nonblocking  
networks.
- 15 92. The network of claim 85,  
wherein each of said input switches, or each of said output switches, or each of  
said middle switches further recursively comprise one or more networks.
93. A network having a plurality of multicast connections, said network comprising:  
an input stage comprising  $r_1$  input switches and  $n_1$  inlet links for each of said  $r_1$   
20 input switches, and  $N_1 = n_1 * r_1$ ;  
an output stage comprising  $r_2$  output switches and  $n_2$  outlet links for each of said  
 $r_2$  output switches, and  $N_2 = n_2 * r_2$ ; and  
a middle stage comprising  $m$  middle switches, and each middle switch  
comprising at least one link connected to each input switch for a total of at least  $r_1$  first  
25 internal links; each middle switch further comprising at least one link connected to at

most  $d$  said output switches for a total of at least  $d$  second internal links, wherein

$$1 \leq d \leq r_2 ,$$

wherein each multicast connection from an inlet link passes through at most three middle switches, and said multicast connection further passes a plurality of outlet links

5 from said at most three middle switches.

94. The network of claim 93, wherein  $m \geq 3 * n_1 + n_2 - 1$ ,

95. The network of claim 94,

further is always capable of setting up said connection by never changing path of a previously set up multicast connection, and the network is hereinafter “strictly

10 nonblocking network”.

96. The network of claim 93 comprising a controller in communication with said input, output and middle stages to set up said multicast connection.

97. The network of claim 94 wherein said  $r_1$  input switches and  $r_2$  output switches are the same number of switches.

15 98. The network of claim 94 wherein said  $n_1$  inlet links and  $n_2$  outlet links are the same number of links and  $n_1 = n_2 = n$ , then  $m \geq 4 * n - 1$ .

99. The strictly nonblocking network of claim 95,

wherein each of said input switches, or each of said output switches, or each of said middle switches further recursively comprise one or more strictly nonblocking

20 networks.

100. The network of claim 93 ,

wherein each of said input switches, or each of said output switches, or each of said middle switches further recursively comprise one or more networks.

101. A network having a plurality of multicast connections, said network comprising:

an input stage comprising  $r_1$  input switches and  $n_1$  inlet links for each of said  $r_1$  input switches, and  $N_1 = n_1 * r_1$ ;

an output stage comprising  $r_2$  output switches and  $n_2$  outlet links for each of said  $r_2$  output switches, and  $N_2 = n_2 * r_2$ ; and

5 a middle stage comprising  $m$  middle switches, and each middle switch comprising at least one link connected to each input switch for a total of at least  $r_1$  first internal links; each middle switch further comprising at least one link connected to at most  $d$  output switches for a total of at least  $d$  second internal links, wherein  $1 \leq d \leq r_2$ , for  $2 \leq x \leq r_2$ ,

10 wherein each multicast connection from an inlet link passes through at most  $x$  middle switches, and said multicast connection further passes a plurality of outlet links from said at most  $x$  middle switches.

102. The network of claim 101, wherein  $m \geq x * n_1 + n_2 - 1$ .

103. The network of claim 102,

15 further is always capable of setting up said connection by never changing path of a previously set up multicast connection, and the network is hereinafter "strictly nonblocking network".

104. The network of claim 101 comprising a controller in communication with said input, output and middle stages to set up said multicast connection.

20 105. The network of claim 102 wherein said  $r_1$  input switches and  $r_2$  output switches are the same number of switches.

106. The network of claim 102 wherein said  $n_1$  inlet links and  $n_2$  outlet links are the same number of links and  $n_1 = n_2 = n$ , then  $m \geq (x + 1) * n$ .